

Aerogel-Ionic Liquid Hybrid Electrolytes, Phase I

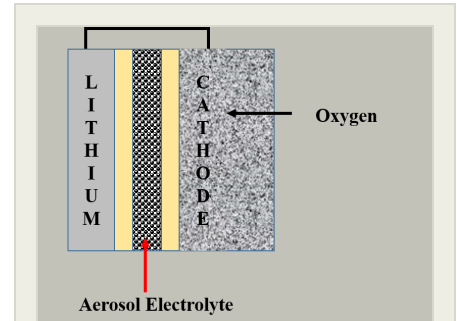
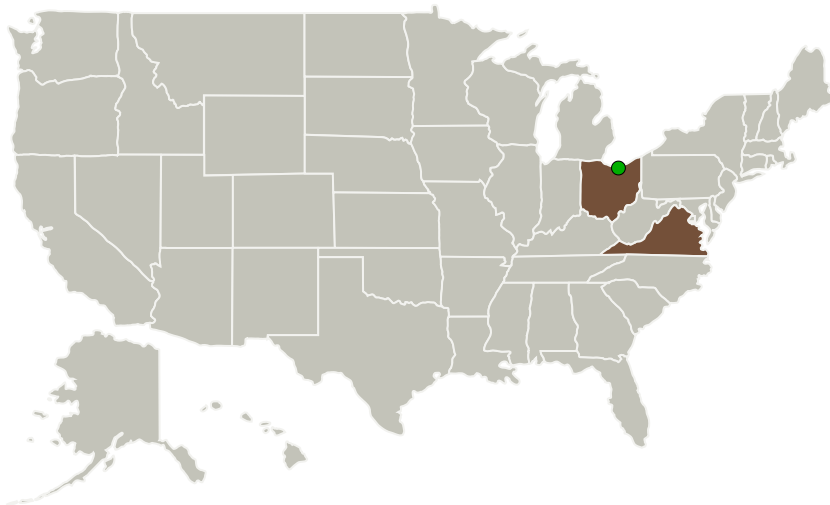
Completed Technology Project (2016 - 2016)



Project Introduction

NASA energy storage requirements for extended human and robotic missions to space require energy generating systems with high specific energy, high volumetric efficiency, greater reliability, reduced parasitic impedance, and low cost/ease of manufacture. Current lithium ion batteries cannot meet the energy requirements of these missions. Lithium-air batteries, where lithium directly reacts with air can potentially have specific energy in the range of in the order $5.2 \times 10^3 \text{ Wh kg}^{-1}$. Realizing such high performance metrics however requires significant advances in component design. The electrolyte to be used in lithium air batteries, for example, must be compatible with lithium metal, and have high ionic conductivity in the order of 10^{-3} Siemens/cm to achieve the promised performance metrics. MMI proposes a novel aerogel-supported ionic liquid electrolyte with very high ionic conductivity for use as electrolyte in high performance lithium air batteries. With ionic conductance in the range of milli-Siemens/cm, this electrolyte, when combined with appropriate electrodes can potentially be used to fabricate lithium air batteries with specific energies as high as 500 Wh/kg and volumetric energy densities in the order of 700 Wh/L .

Primary U.S. Work Locations and Key Partners



Aerogel-Ionic Liquid Hybrid Electrolytes, Phase I

Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3
Target Destinations	3

Aerogel-Ionic Liquid Hybrid Electrolytes, Phase I

Completed Technology Project (2016 - 2016)



Organizations Performing Work	Role	Type	Location
Materials Modification, Inc.	Lead Organization	Industry Small Disadvantaged Business (SDB)	Fairfax, Virginia
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Ohio	Virginia

Project Transitions

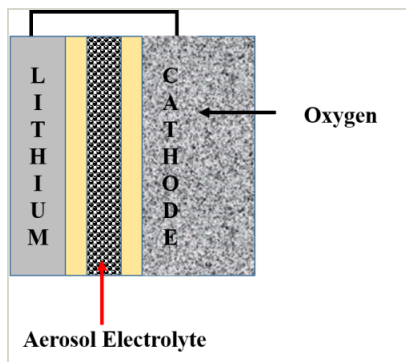
▶ **June 2016:** Project Start

✓ **December 2016:** Closed out

Closeout Documentation:

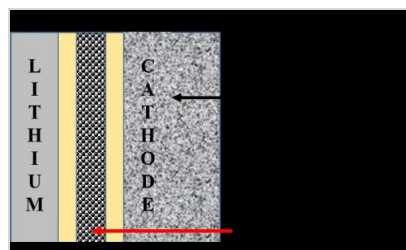
- Final Summary Chart(<https://techport.nasa.gov/file/140088>)

Images



Briefing Chart Image

Aerogel-Ionic Liquid Hybrid Electrolytes, Phase I
(<https://techport.nasa.gov/image/133250>)



Final Summary Chart Image

Aerogel-Ionic Liquid Hybrid Electrolytes, Phase I Project Image
(<https://techport.nasa.gov/image/134784>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Materials Modification, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

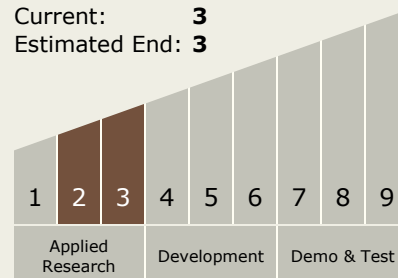
Carlos Torrez

Principal Investigator:

Krishnaswamy K Rangan

Technology Maturity (TRL)

Start: 2
Current: 3
Estimated End: 3



Aerogel-Ionic Liquid Hybrid Electrolytes, Phase I

Completed Technology Project (2016 - 2016)



Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
 - └ TX03.2 Energy Storage
 - └ TX03.2.1 Electrochemical: Batteries

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System